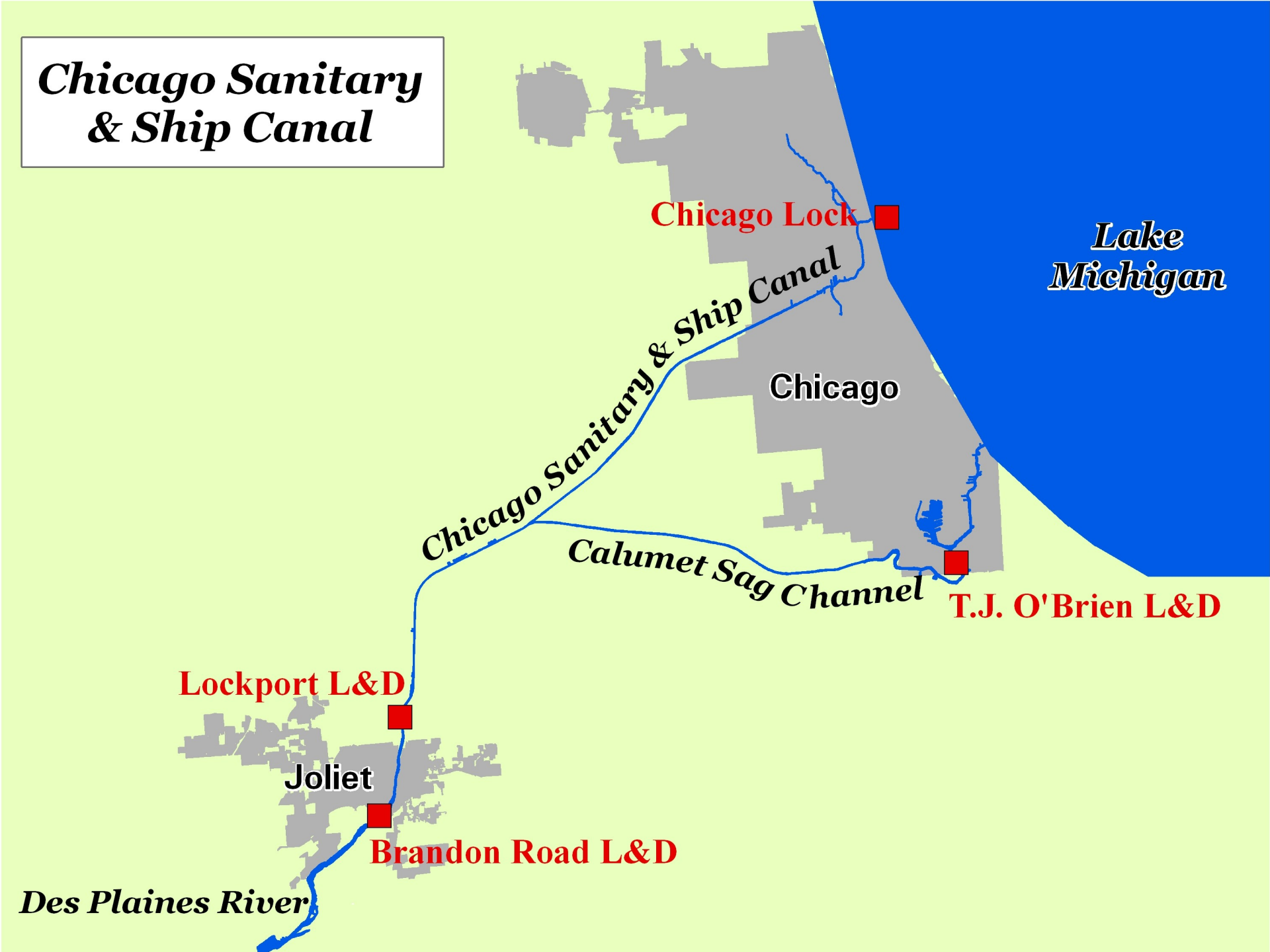
Presentation
to the
Inland Waterways Users Board

Lockport Pool
Chicago Sanitary & Ship Canal
Illinois Waterway

by
Gary Loss, P.E.
Rock Island District

July 13, 2006


Chicago Sanitary & Ship Canal
Chicago Lock
Lake Michigan
Chicago Sanitary & Ship Canal
Chicago
Calumet Sag Channel
T.J. O'Brien L&D
Lockport L&D
Joliet
Brandon Road L&D
Des Plaines River

Illinois Waterway
Chicago Lock
Lake Michigan
Chicago Sanitary & Ship Canal
Chicago
Lockport L&D
T.J. O'Brien L&D
Brandon Road L&D
Dresden Island L&D
Starved Rock L&D
Calumet Sag Channel
Des Plaines River
Marseilles L&D
Peoria L&D
Illinois River
La Grange L&D
Mississippi River
Grafton

Chicago Sanitary and Ship Canal

US Army Corps of Engineers®

A Landmark Civil Engineering Project

Reversing the Chicago River from Lake Michigan to the Il

US Army Corps of Engineers®

History of the CSSC

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

US Army Corps of Engineers®

Authorization History

- Public Law 97-377 directed the Department of the Army to implement the provisions of PL97-88, which provided that “funds made available to the Corps of Engineers-Civil for O&M of the Illinois Waterway shall be available to operate and maintain the Chicago Sanitary and Ship Canal portion of the Waterway in the interest of navigation.”
- Public Law 98-63, clarified that the CSSC “includes the Control Structure and Lock in the Chicago River and other facilities as are necessary to sustain through navigation from Chicago Harbor on Lake Michigan to Lockport on the Des Plaines River.”

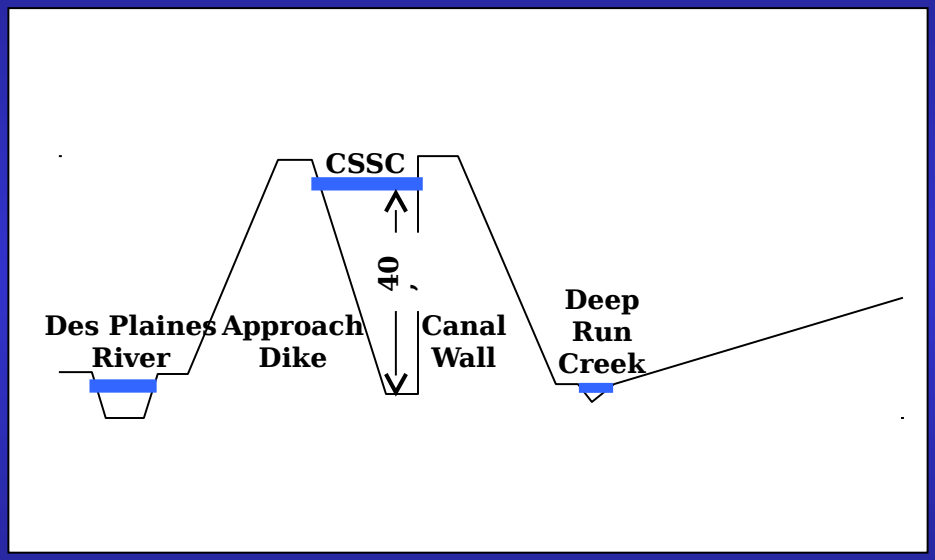
US Army Corps of Engineers®

1984 Memorandum of Agreement

- CSSC operated for sanitary, flood control and navigation purposes. Until 1984, specific responsibilities were vague.
- MOA executed in 1984 between Department of Army (DA) & Metropolitan Water Reclamation District of Chicago (MWRD)
- DA agreed to maintain
  - Controlling Works foundation, piers and dolphins
  - Lockport Lock (including operation)
  - Approach embankment upstream to Controlling Works
  - Powerhouse & Dam gravity (water retaining) structures
  - Concrete guide wall upstream to Damen Ave

US Army Corps of Engineers®

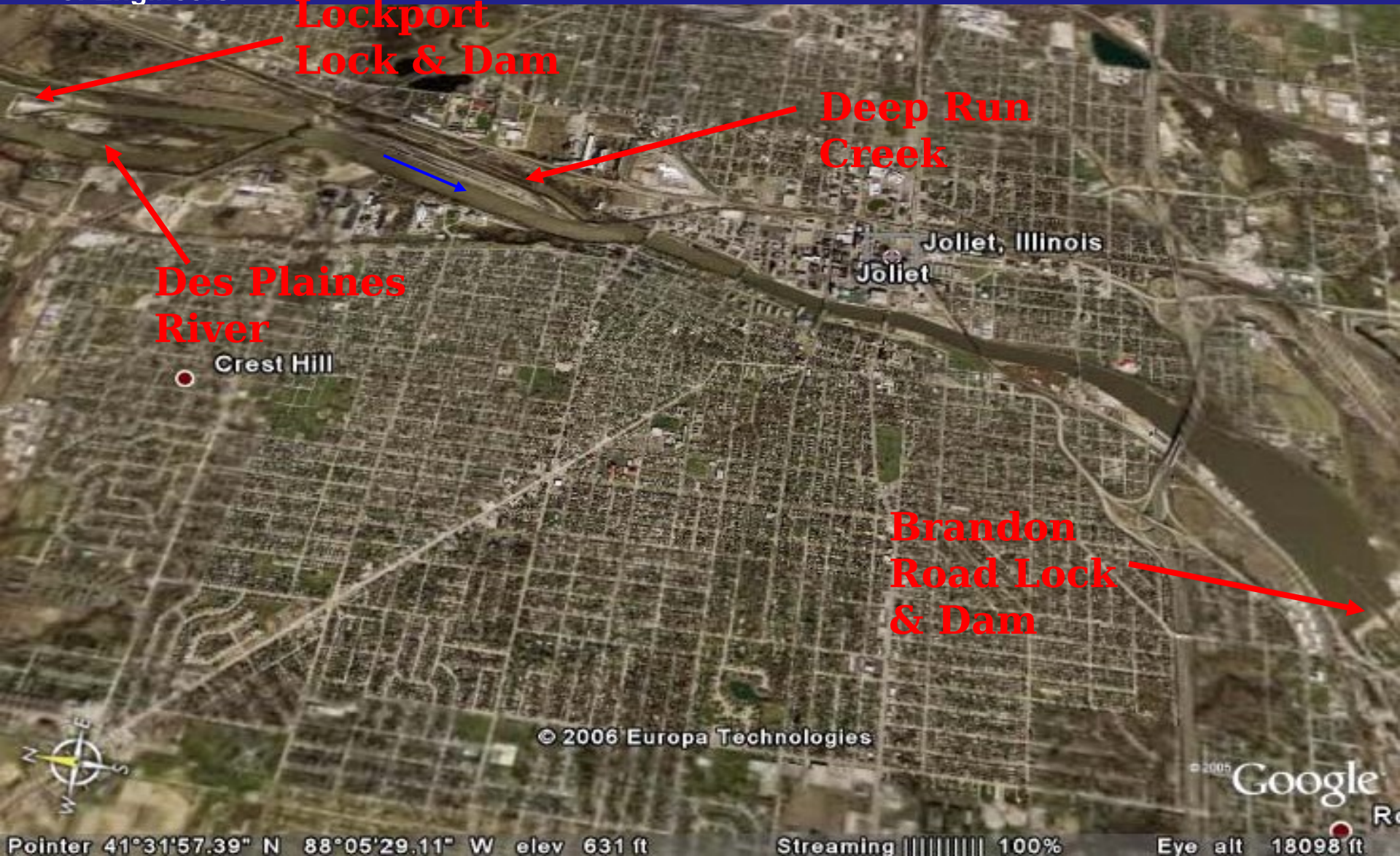
Chicago Sanitary & Ship Canal (CSSC) on the Illinois Waterway



Lockport Pool
@ Downstream End Of the CSSC

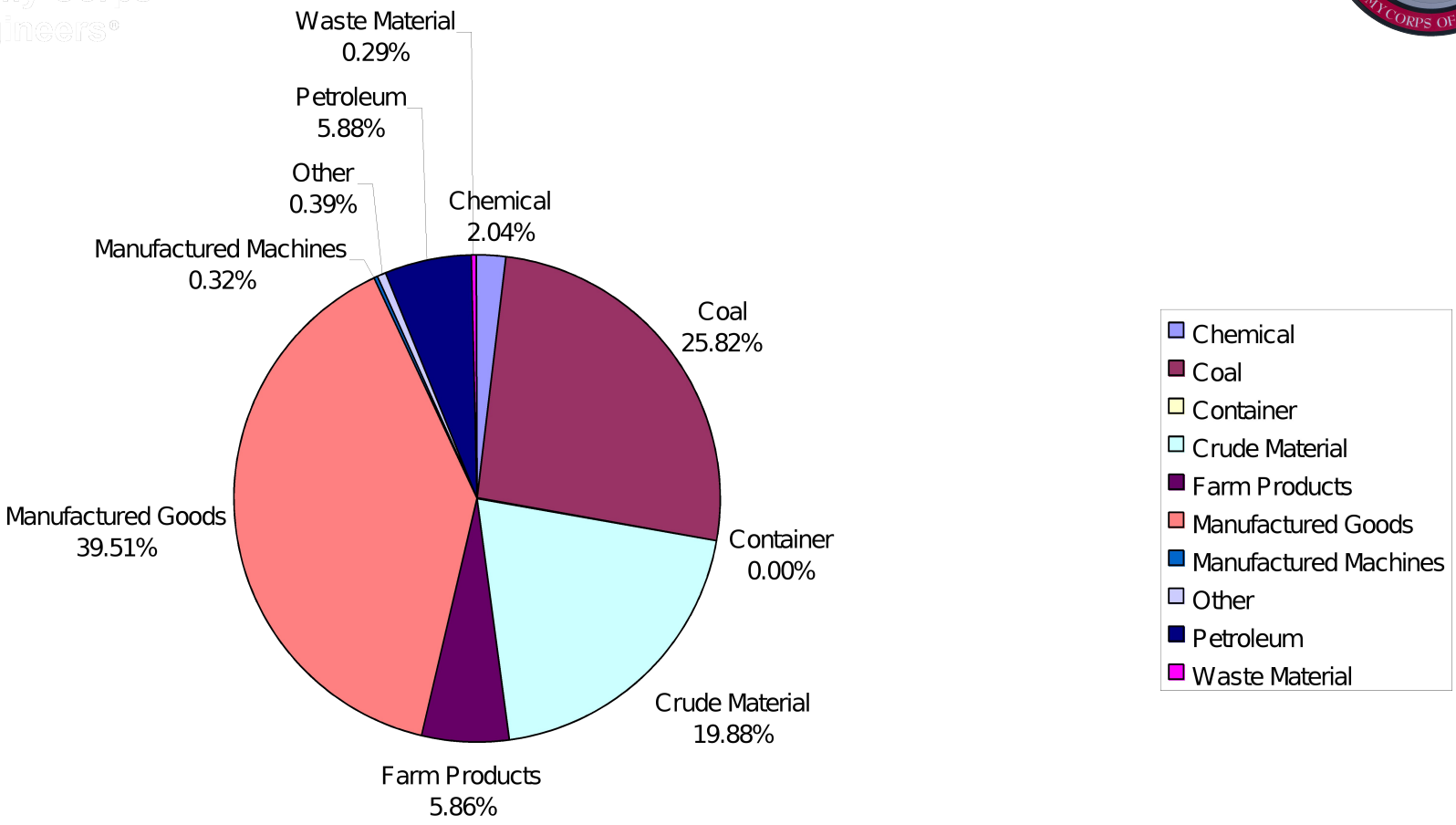
Lockport to Brandon Road

US Army Corps of Engineers®



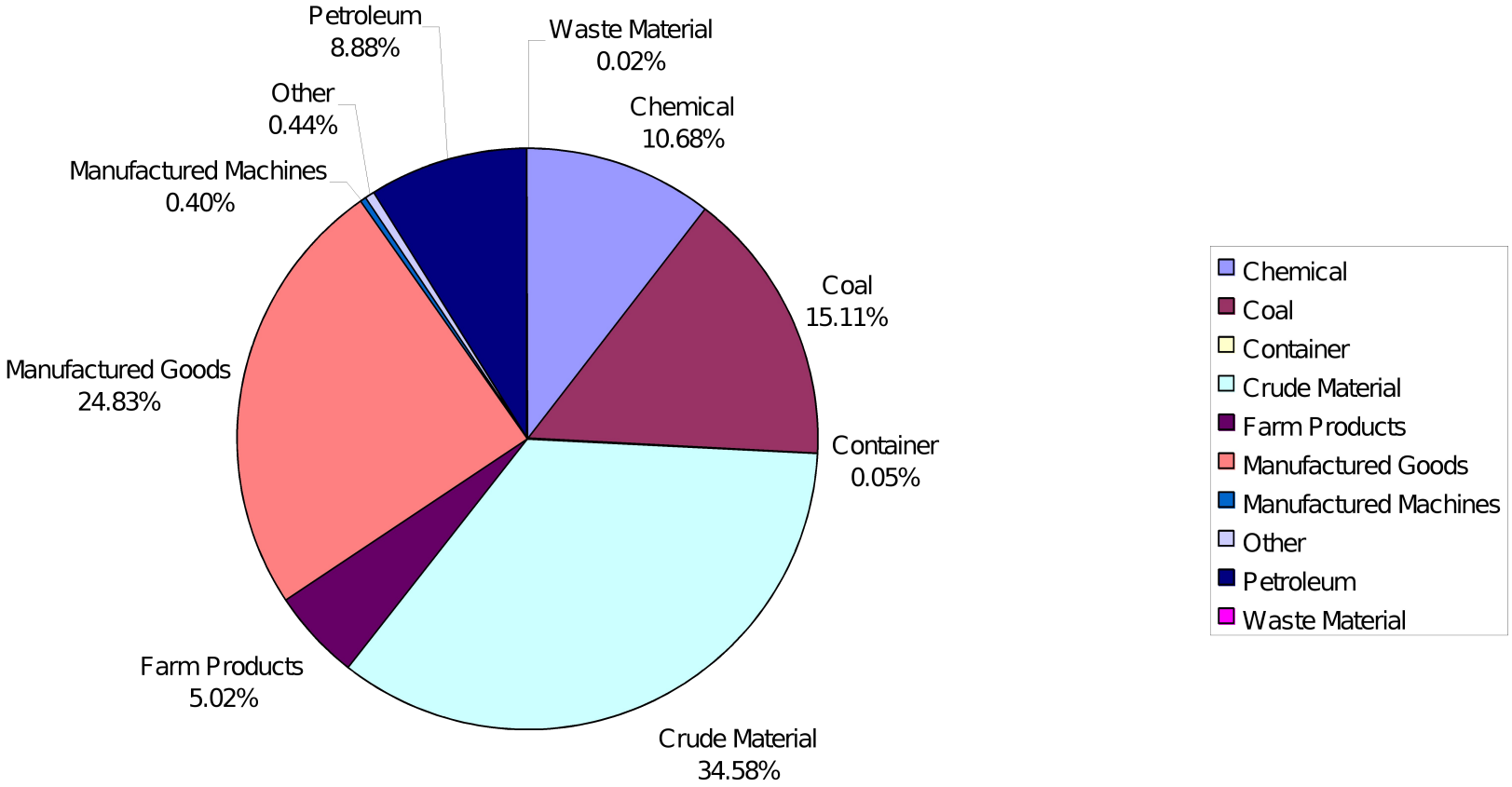
US Army Corps of Engineers®

Illinois Waterway - T.J . O'Brien Lock & Dam
2005 Total Tonnage by Commodity
Total Tons: 9,048,078



US Army Corps of Engineers®

Illinois Waterway - Lockport Lock & Dam
2005 Total Tonnage by Commodity
Total Tons: 16,929,707



US Army Corps of Engineers®

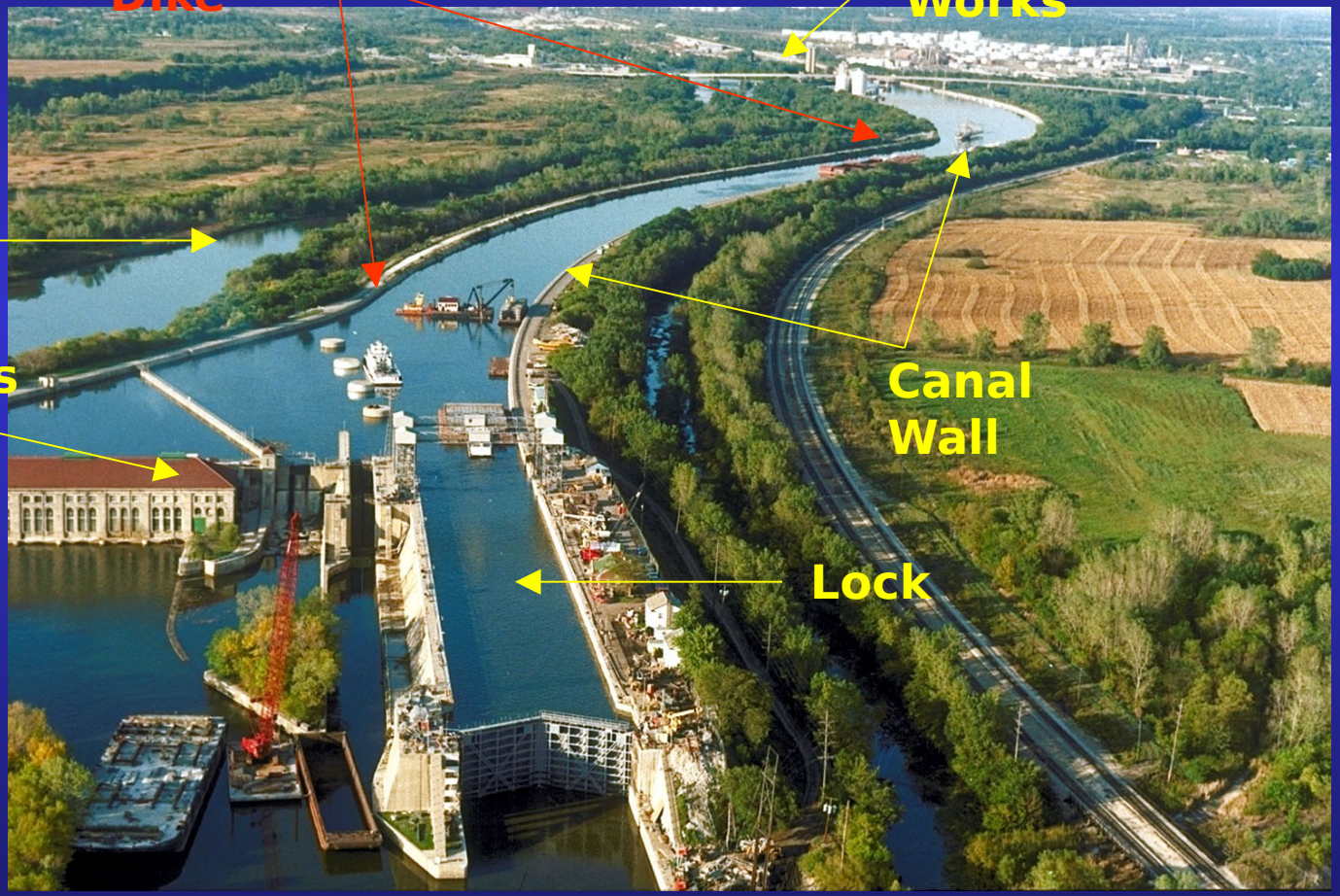
Lockport Pool RER

- **MVR prepared a Rehabilitation Evaluation Report for Major Rehab program funding on 5 project features in the Lockport Pool, River Mile 291 to 293.2.**
  - **Submitted in March 2004**
  - **Approved in November 2004**

- **Five Project Features (per requested funding source)**
  - **Major Rehabilitation (Rehab/TF)**
    - **Controlling Works**
    - **Concrete Canal (Guide) Wall**
    - **Approach Dike**
  - **Operations and Maintenance (O&M)**
    - **Powerhouse**
    - **Embankment Clearing**

US Army Corps of Engineers®

Lockport Pool Reach



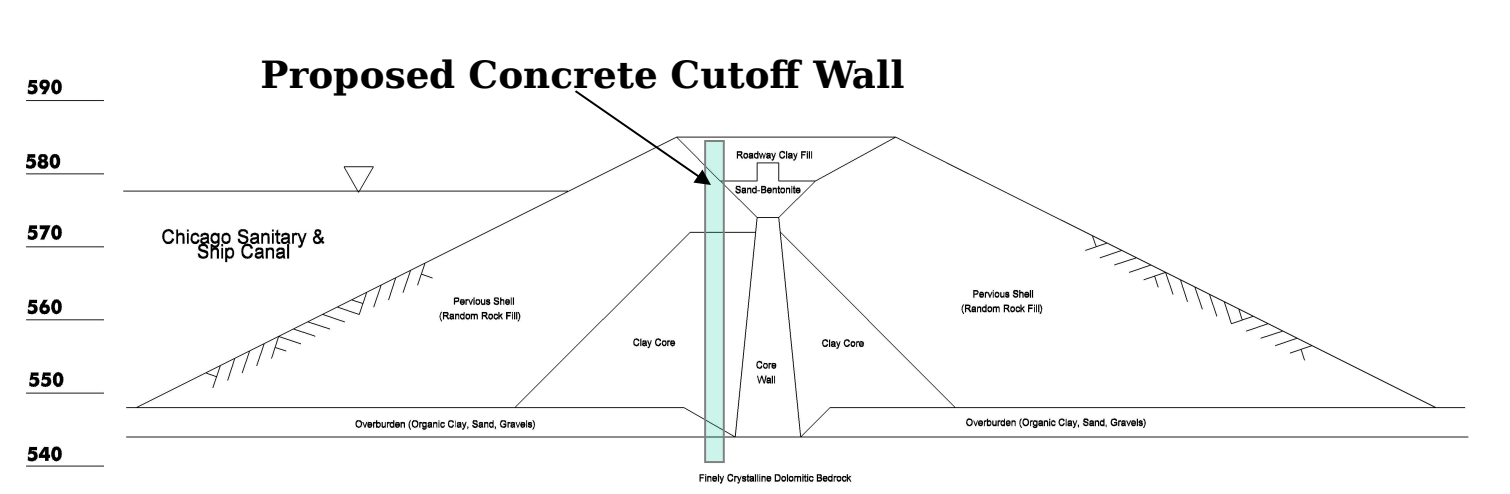
US Army Corps of Engineers®

Approach Dike
(Right Descending Bank)

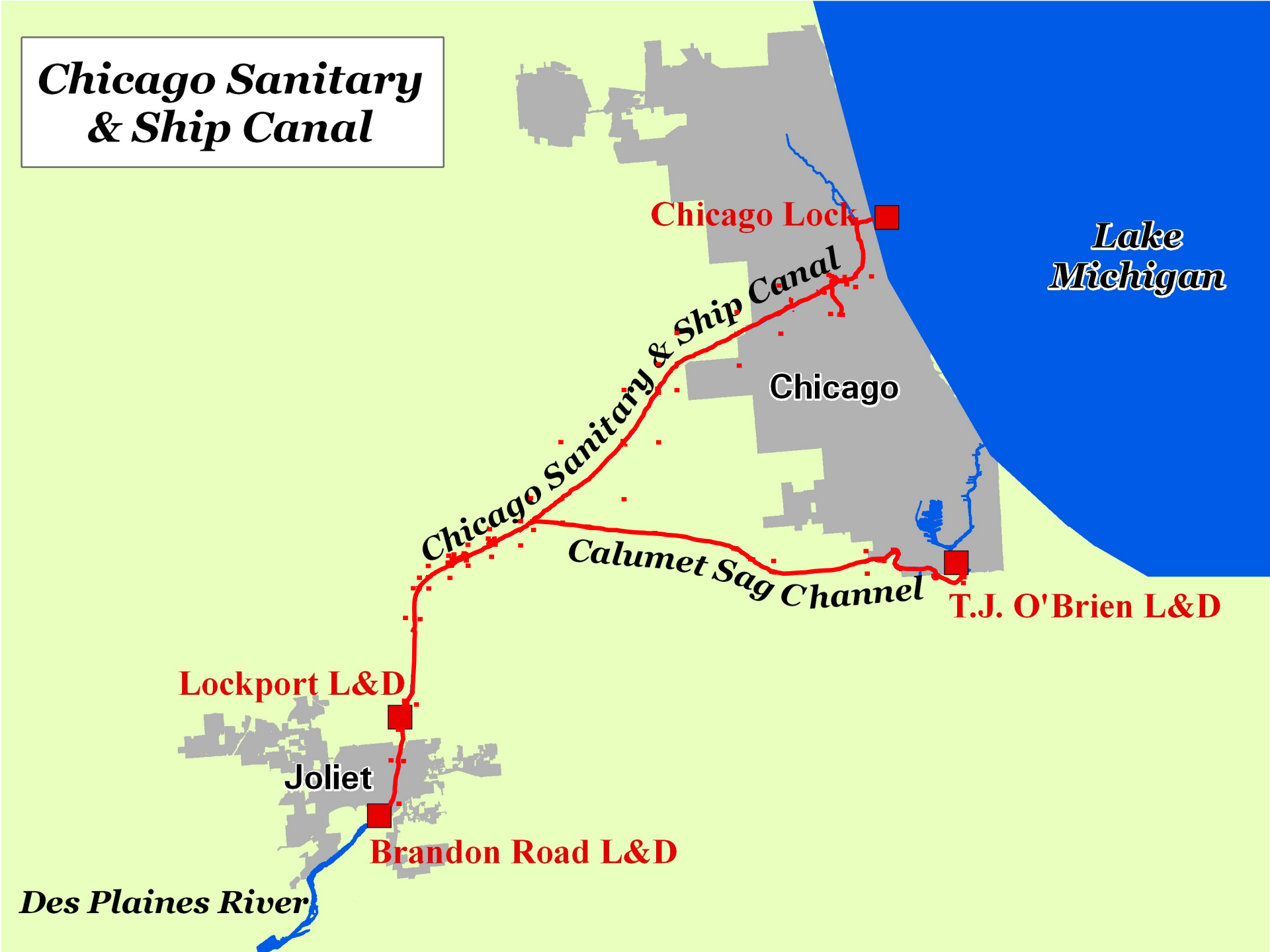
- Constructed in early 1900's
  - 4,300 feet in length above the Powerhouse.
  - Acts as high-hazard dam
- Early CSSC pool raise places canal levels above the core wall top.
- Constant seepage with chronic sinkhole development.

US Army Corps of Engineers®

Approach Dike

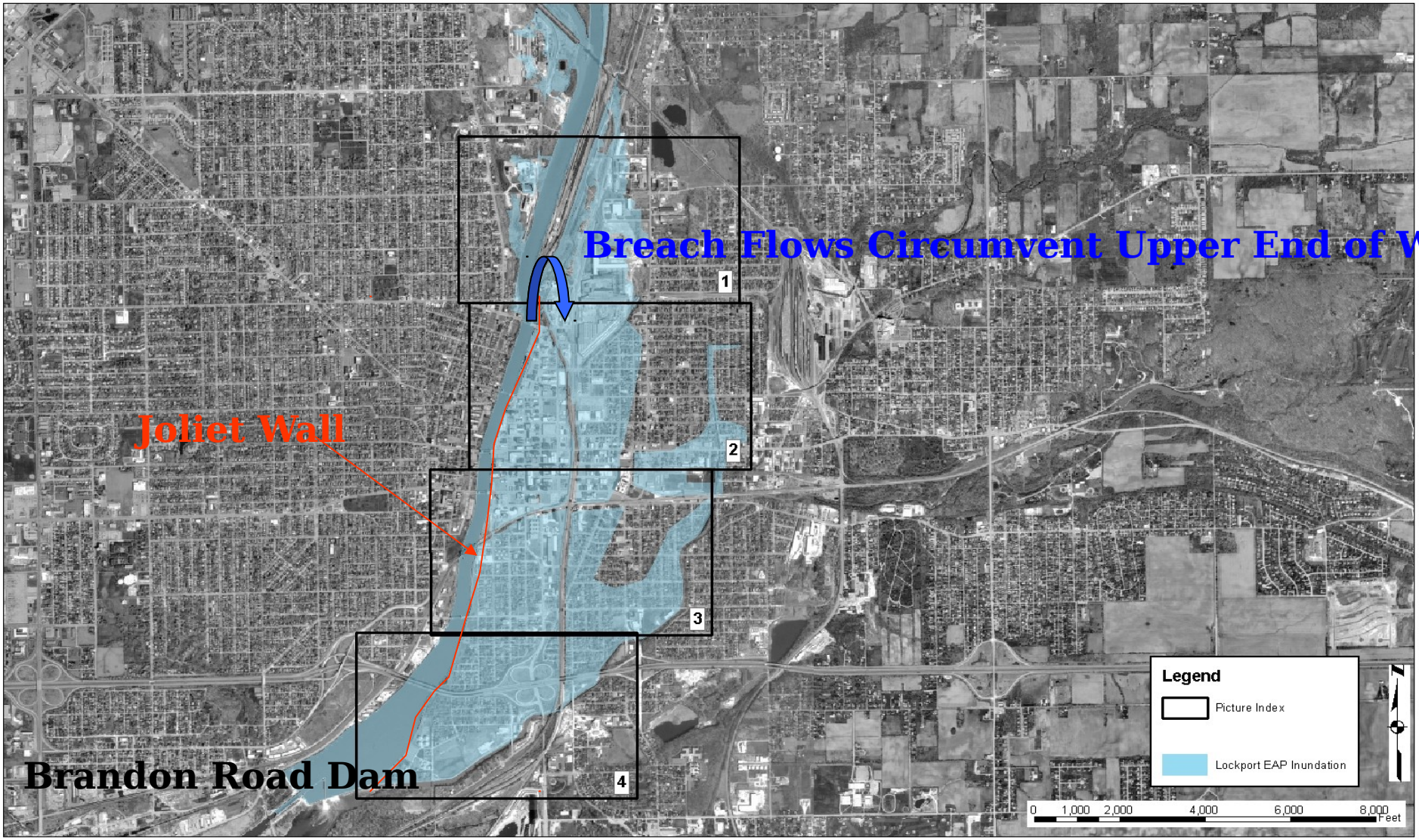


- **Recent actions**
  - 1992 – Sand/bentonite cap installed. Seepage continued.
  - 1997 – 100-foot length of test sheet pile wall installed at location of a major sinkhole. Seepage continues.
- **Rehabilitation Scope**
  - Must be done while maintaining navigation & hydropower
  - Concrete seepage cutoff placed via slurry trench
  - $23.6 million (Rehab/TF)


Chicago Sanitary & Ship Canal
Chicago Lock
Lake Michigan
Chicago
Chicago Sanitary & Ship Canal
Calumet Sag Channel
T.J. O'Brien L&D
Lockport L&D
Joliet
Brandon Road L&D
Des Plaines River

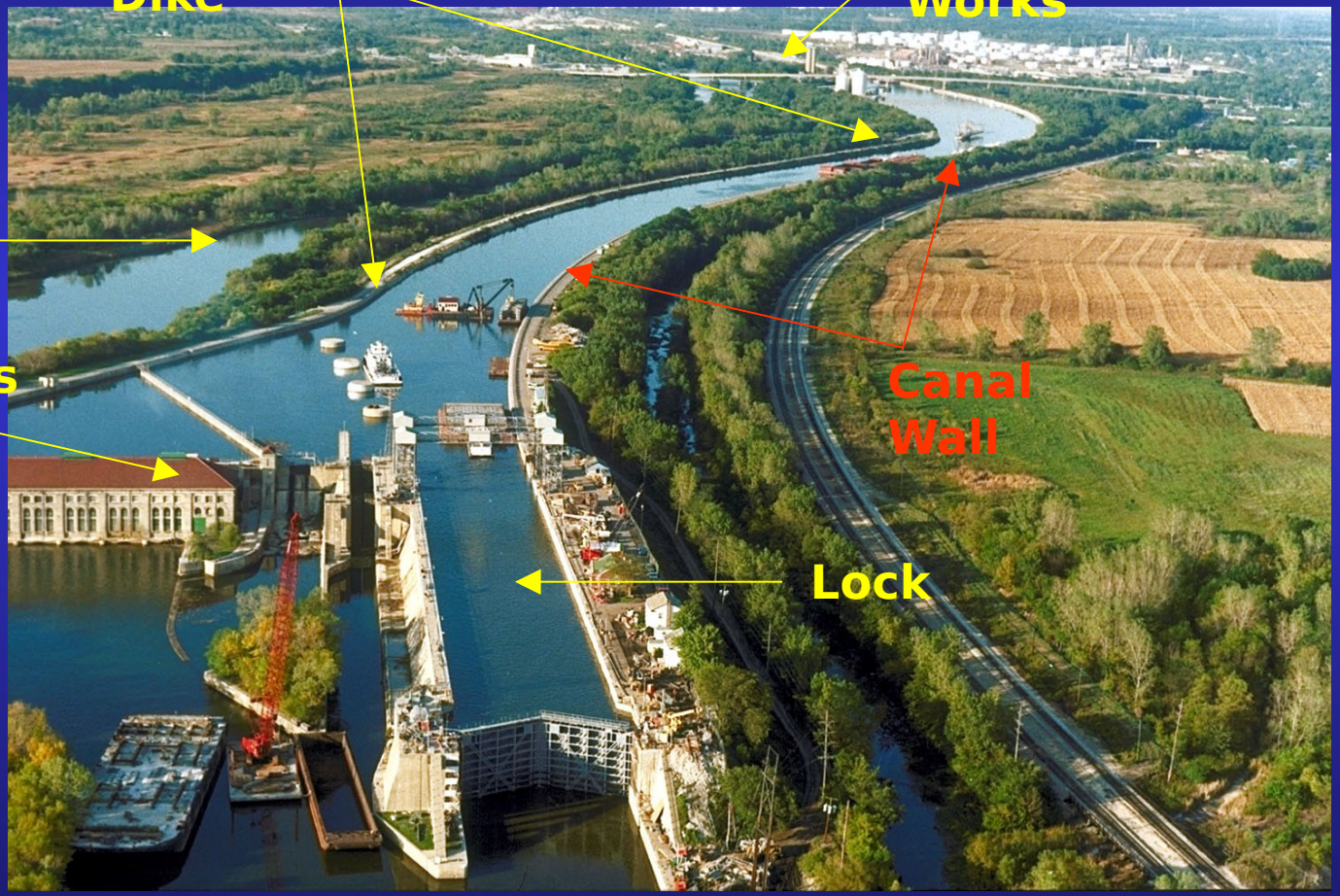
US Army Corps of Engineers®

Joliet Inundation Area



US Army Corps of Engineers®

Lockport Pool Reach



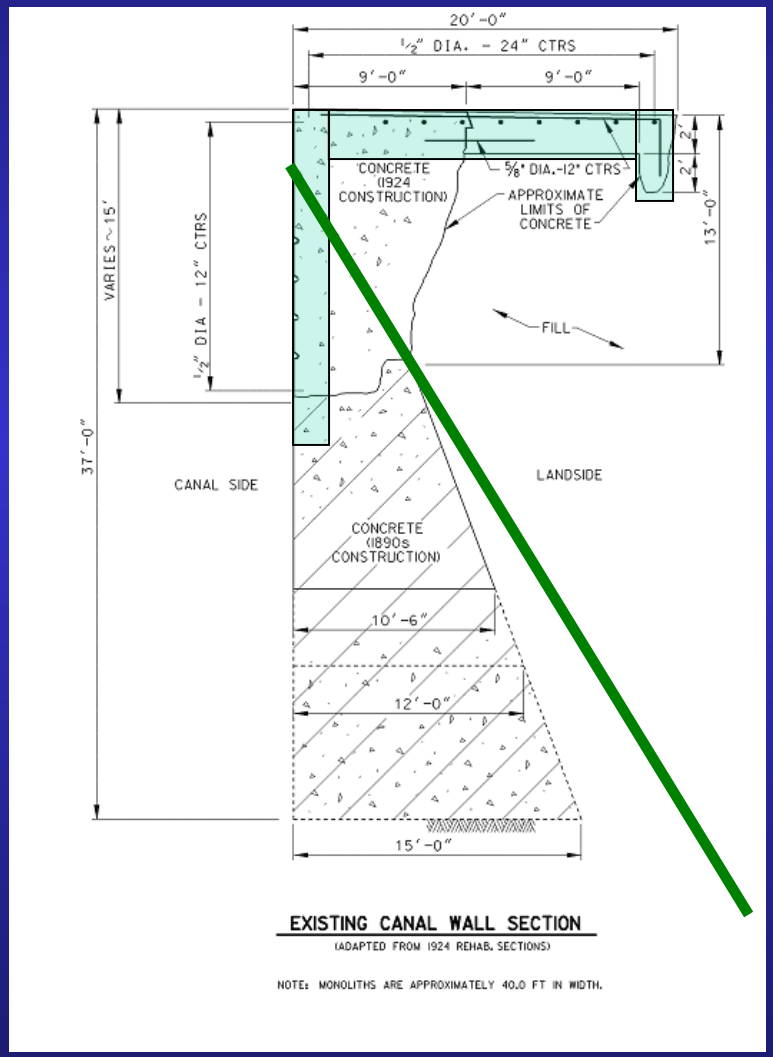
Concrete Canal Wall
(Left Descending Bank)

US Army Corps of Engineers®

- Lockport Pool reach has 399 monoliths, 60 with barge check posts.
- Acts as a high-head dam with maximum 40-foot head.
- Serious concerns of structural stability and integrity.

US Army Corps of Engineers®

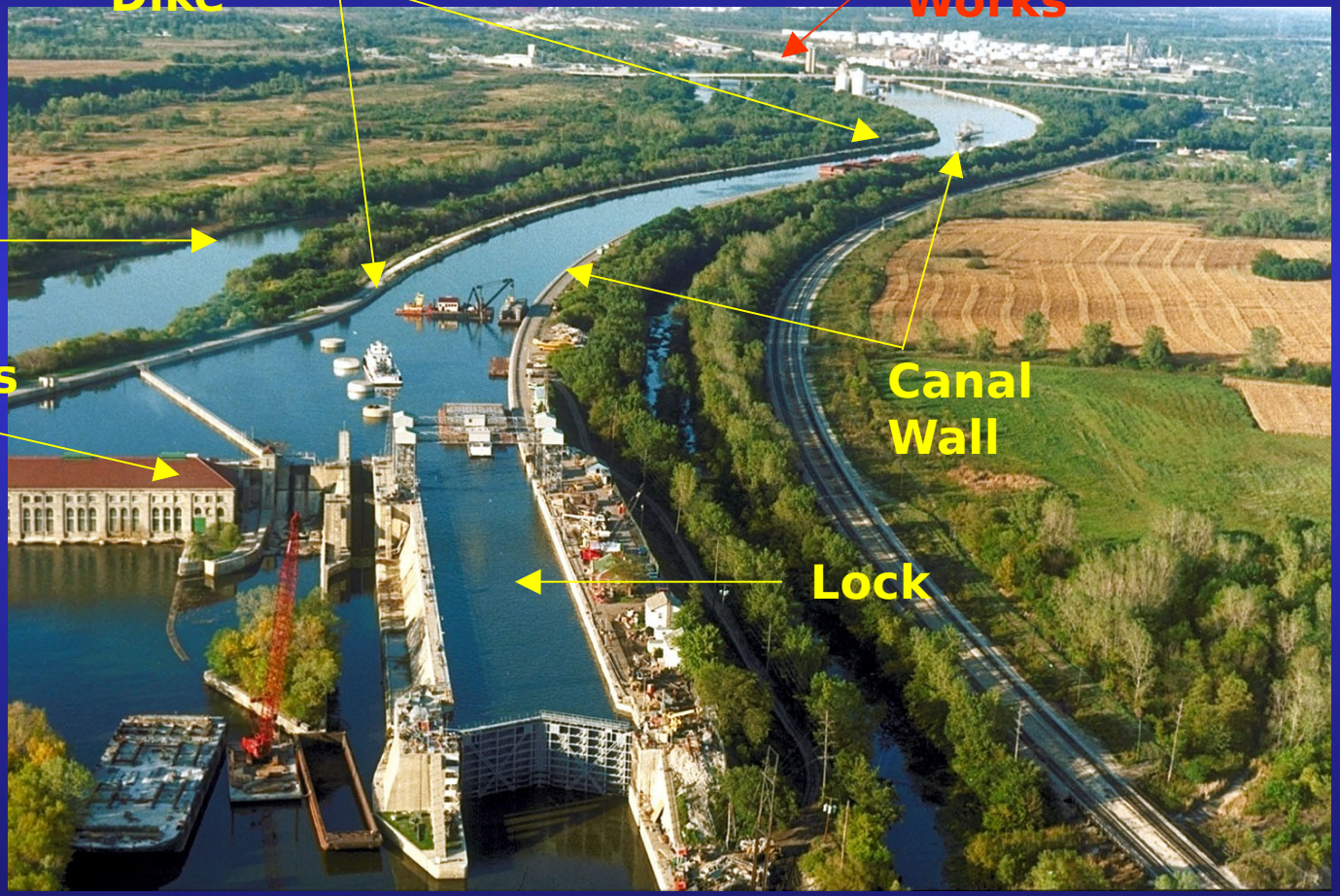
Concrete Canal Wall



- **Original Construction**
  - 1890's – lower 22 feet, lime cement concrete, 800 psi
  - 1924 – upper 15 feet, Portland cement concrete
  - No bond between the 2 parts
- **Rehabilitation Scope**
  - Must be done while maintaining navigation and hydropower
  - Pre-cast vertical face panels
  - New horizontal tie-back concrete
  - Rock anchors
  - $87 million in repairs (Rehab/TF) for first 3 miles

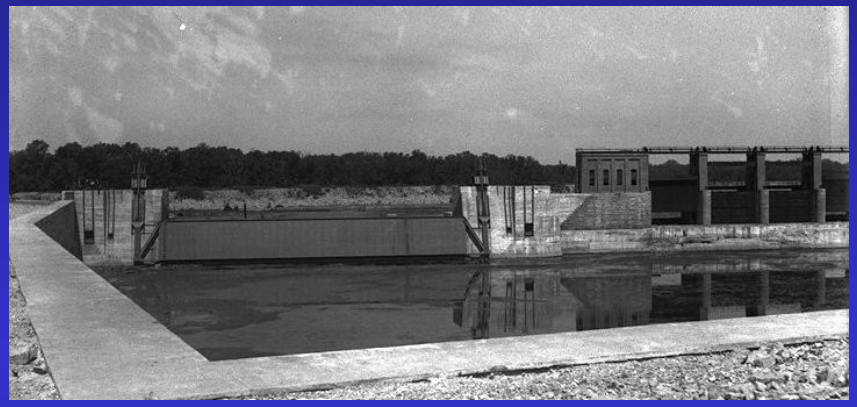
US Army Corps of Engineers®

Lockport Pool Reach



US Army Corps of Engineers®

Controlling Works



- 1890's Construction
- Releases stormwater to Des Plaines River during heavy rainfall
- Lowers CSSC water levels 5-10 feet within the Lockport Pool.
- Operated by MWRD
- MWRD wants to operate remotely.

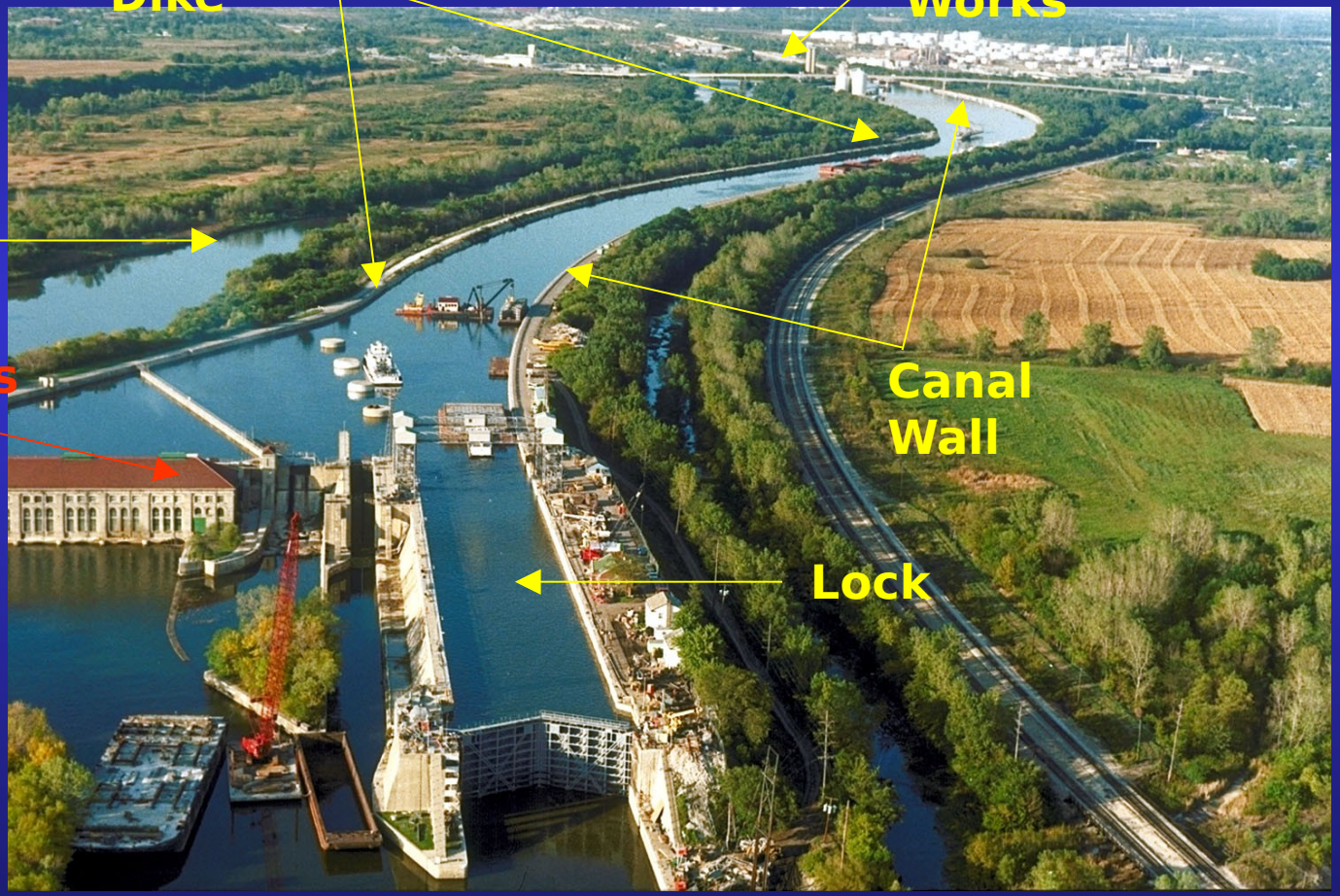
US Army Corps of Engineers®

Controlling Works

- **Rehabilitation Scope**
  - **Concrete repairs, stone work, brick tuck pointing**
  - **Embankment reshaping, riprap**
  - **$1.4 million of repairs (Rehab/TF)**

US Army Corps of Engineers®

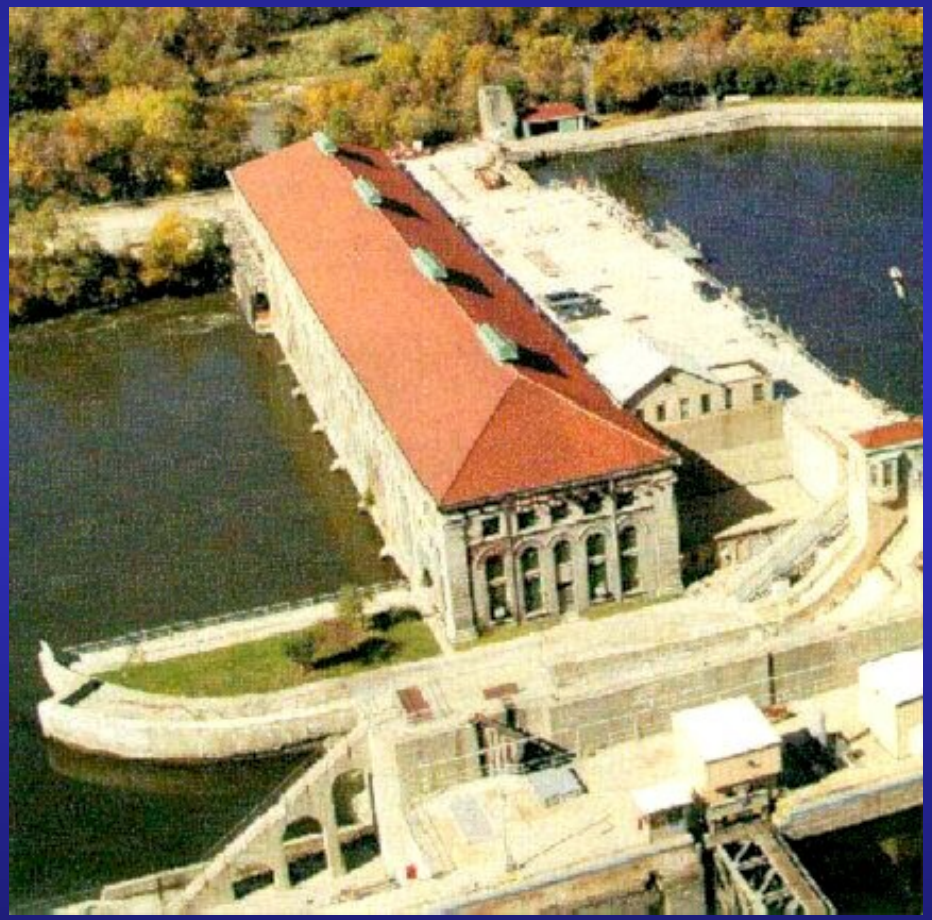
Lockport Pool Reach



US Army Corps of Engineers®

MWRD Powerhouse

- Constructed in 1905-07
- Powerhouse & Dam
  - Abandoned I&M Canal Lock
  - 48- & 12-foot spillways
  - Powerhouse
- Operated by MWRD
  - CSSC pool regulation
  - Hydropower



US Army Corps of Engineers®

MWRD Powerhouse

- 48-foot spillway
  - Spillway chute concrete is in very poor condition.
  - Used on limited basis to pass debris.
  - MWRD wants to use for routine pool regulation.
- 12-foot spillway
  - Bulkhead concrete deterioration
- Rehabilitation Scope
  - No Powerhouse work
  - $1.2 million in spillway concrete replacement (O&M)

US Army Corps of Engineers®

Embankment Clearing

- **Massive embankment overgrowth**
  - **Became Corps' responsibility in 198**
  - **Impossible to reliabl monitor or inspect**
  - **On MVR Critical O&M Backlog List**
- **Rehabilitation Scop**
  - **Clearing of trees and brush**
  - **$1.8 million (O&M)**

US Army Corps of Engineers®

Project Cost Summary

PROJECT COST SUMMARY

Description	Major Rehab	O&M	Total
Dam and Powerhouse	$ 1,174,500	$ 1,174,500	
Concrete Canal Wall	$86,940,000	$86,940,000	
Approach Dike	$23,639,800	$23,639,800	
Embankment Clearing		$ 1,843,800	$ 1,843,800
Controlling Works	$ 1,396,700	$ 1,396,700	
Total Project	***$111,976,500***	***$ 3,018,300***	***$114,994,800***

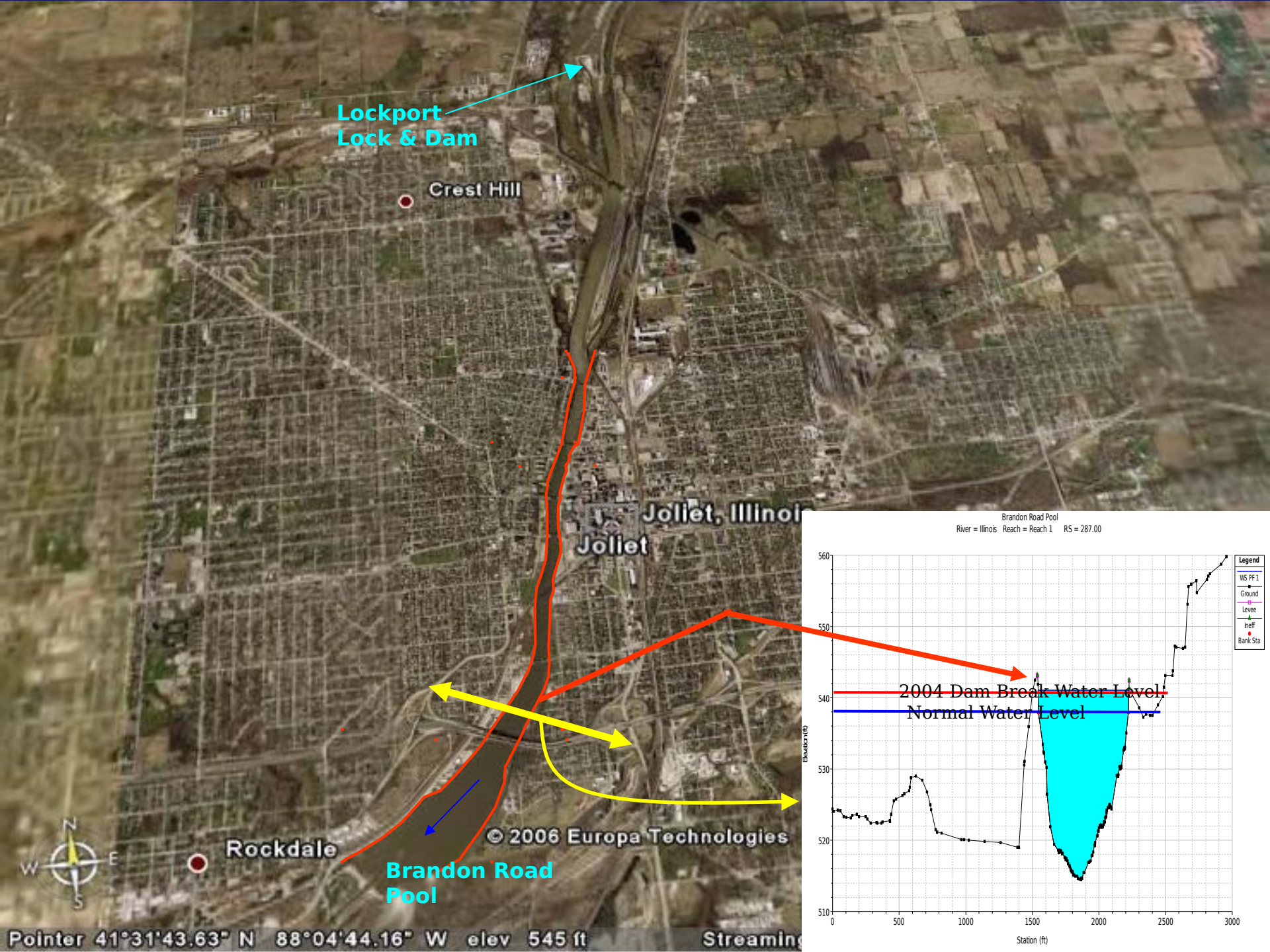
BENEFIT:COST RATIOS

- ***Concrete wall 1.44***
- ***Approach dike 1.20***
- ***Controlling works 5.39***

US Army Corps of Engineers

Screening for Portfolio Risk Analysis (SPRA)

- July 2005 – National Cadre #2 Findings
  - Approach Dike > Inadequate for all 5 Load Cases
  - Concrete Canal Wall > Inadequate for all 5 Load Cases
  - Highest Ranking USACE Navigation Dam from SPRA
  - High economic losses
  - Loss of Life issues indeterminate


Lockport
Lock & Dam
Crest Hill
Joliet, Illinoi
Joliet
Rockdale
Brandon Road
Pool
© 2006 Europa Technologies
N
W
E
S
Pointer 41°31'43.63" N 88°04'44.16" W elev 545 ft
Streaming
Brandon Road Pool
River = Illinois Reach = Reach 1 RS = 287.00
2004 Dam Break Water Level
Normal Water Level
Legend
WS PF 1
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
560
550
540
530
520
510
0
500
1000
1500
2000
2500
3000

Lockport Pool Dam Break Analyses

US Army Corps of Engineers®

- **Feb 2006 Preliminary Review**

  Two scenarios (both with significant impact to navigation):

  - **Joliet Walls <u>are not</u> Breached and Brandon Road Dam reacts according to EAP:**
    - **SDF w/ Breach Flows ~ 3,000 cfs peak flow into Joliet**
    - **Sunny Day Failure ~ minor flow into Joliet**
  - **Joliet Walls <u>are</u> Breached or Fails**
    - **Brandon Road Dam does not react > Joliet Walls could be overtopped.**
    - **Run-away barges could impact the wall with possible failure.**
    - **Catastrophic Loss of Life will likely occur.**

Lockport
Lock & Dam
Joliet
Joliet, Illinois
Joliet Walls
Hickory Creek
Brandon Road Pool
N
W
E
S
Google

US Army Corps of Engineers®

Brandon Road Pool

Towards upstream end of the Joliet Wall (left descending bank)

US Army Corps of Engineers®

Lockport Pool Recommendations

- FY 06 $500k wedge funding for engineering of Approach Dike and Canal Wall rehab.
- FY 07 $1.5m wedge funding for engineering of Approach Dike rehab
  - Capability of additional $1.5m additional for continued engineering of Canal Walls rehab.
- FY 08 Initiate rehab construction on Controlling Works and Approach Dike
- FY 09 Initiate rehab construction on Canal Walls